

SP-F1 Evaluation of Project Effects on Non-fish Aquatic Resources*October 25, 2002***1.0 Introduction/Background**

Several fisheries and non-fisheries aquatic resource related issues were identified during the collaborative scoping process for this project. **Issue F1** focuses on the issues, concerns, and opportunities associated with the potential effects of existing and future project operations on the behavior, reproduction, survival, and habitat of warm- and cold-water fish and other aquatic organisms within the project waters. **Issue F3** documents the concerns regarding the potential effects of existing and future project operations on resident fish species habitat quantity and quality as well as the habitat for other aquatic species. Several other study plans focus on the evaluation of project effects to the fishery resources. The assessment proposed in this study plan focuses on the effects of existing and future operations on non-fish aquatic organisms (i.e., phytoplankton, zooplankton, and aquatic macroinvertebrates).

The investigation proposed in this study plan will require data collection efforts unique to the study of aquatic macroinvertebrates and plankton. In addition, the overall analyses conducted during the course of implementing the proposed study will rely upon data collected through implementation of other studies that focus on information about water quality, fisheries resources, and hydrologic/hydraulic conditions. For that reason it is important that all of the study efforts be coordinated to insure that duplication of effort, incompatible data collection efforts, or data gaps are reduced. Additionally, study plan integration and coordination could potentially reduce the quantity and improve the quality of data needed to support the various individual studies necessary to complete required analysis of the Resource Issues, Concerns, and Comments derived from the collaborative scoping process. Finally, coordination with other investigators should assure that study design developed includes collection of data potentially useful for other study plans.

Study Purpose: The purpose of this study is to document the existing condition and evaluate the operational effects of the project on aquatic macroinvertebrates, phytoplankton, and zooplankton residing in the project reservoirs and river habitats within the project area. The project has the potential to affect aquatic macroinvertebrates and plankton communities directly by operations or related actions that affect water quantity or quality parameters such as river flows, reservoir surface elevation, turbidity, dissolved oxygen, and temperature. In addition, project actions that result in changes in fish abundance or the introduction/removal of fish species would have indirect, trophic level effects on the aquatic communities of interest.

Information collected from this and other study plans will facilitate our understanding of the potential changes in the physical, chemical, and/or biological resources associated with future changes in project operations. Potential effects on plankton and macroinvertebrates associated with the existing condition and any proposed operational changes, will be assessed through an evaluation of published scientific data from other similar facilities and data collected as part of the field investigations associated with this and other study plans. All potential project-related effects will be described in terms of changes to water quality or quantity parameters and subsequent likely effects on the existing aquatic macroinvertebrate and plankton communities.

The Importance of Aquatic Macroinvertebrates and Plankton to Fisheries Resources: Aquatic macroinvertebrates and plankton communities are important components of the food web in the various impoundments within the Project area as well as the tributaries upstream from Lake Oroville and the Feather River downstream from Oroville Dam. The plankton communities form the food web for most fish species residing in Lake Oroville and the Thermalito Diversion Pool, Forebay, and Afterbay. Similarly, aquatic macroinvertebrates are a major component of the food web for most fish species found in the Feather River tributaries that drain into Lake Oroville and the Feather River downstream of the Fish Barrier Dam. Aquatic macroinvertebrates and plankton harvest aquatic bacteria and other organic materials, thereby assimilating carbon, nitrogen, phosphorus, sulfur, and other trace elements. In turn, aquatic macroinvertebrates and plankton are the food organisms utilized by fish at various lifestages. At some lifestages and during certain times of the year plankton are cropped more extensively than aquatic macroinvertebrates. Both are important food organisms for fish species found within the Oroville Facilities and provide the critical inorganic and organic nutrients needed for fish species to survive and propagate.

Changes in aquatic macroinvertebrates and plankton can be associated with variations in water quality, water quantity, and/or harvesting intensities (feeding rates). For example, changes in water temperature can result in changes in species composition that are as dramatic as the permanent elimination of some species from the community. A shift in predatory species or a change in abundance of predators/foragers within the system may similarly alter the macroinvertebrate and plankton community structures. Such community level changes may, or may not, be reflected in total biomass or production estimates, but should be indicated in an evaluation of taxonomic (e.g. Cladocerans, Ephemeroptera, etc.) and/or functional groups (e.g. grazers, scrapers, etc.) represented within the aquatic macroinvertebrate and plankton communities. The composition of macroinvertebrate and plankton communities, including representation by a diversity of functional groups and size structures, is an indicator of system health and long-term water quality conditions that may not be evident from traditional water quality sampling.

Chemical, biological, and physical parameters correlated with aquatic macroinvertebrate and plankton communities could be changed by alternative project operations, and therefore must be evaluated to determine existing baseline conditions. For example, changes in basic water chemistry, important nutrients, water temperature regimes, downstream flow regimes, stream substrate composition, and rate and extent of reservoir water surface elevation changes could result in changes to the plankton and macroinvertebrate communities within project waters. Even if changes were predicted or suspected as a result of this study, those changes might not result in a negative impact to aquatic macroinvertebrate or plankton resources. An important aspect of this study is the determination whether any predicted or suspected changes would result in negative impacts. To successfully evaluate the effects of continued operation or of operational changes there must first be a clear identification and understanding of what potential operational changes may be implemented, how those changes could affect important chemical, physical, and biological parameters, and whether those changes would result in adverse changes to plankton and macroinvertebrate communities or the habitats upon which they depend.

Data collection for this study will be limited to compiling available existing data, such as the information on plankton and aquatic macroinvertebrates obtained in SP-W1 and results of the DWR-CSU Chico invertebrate study. The information collected will provide a “snap shot” of the existing conditions within the project area. The first task in this study is designed to review available literature and collate project specific data.

Subsequently, this information will be used to assess the effects of changes in reservoir and downstream operations on the aquatic macroinvertebrate and plankton resources. Because of the complications associated with trophic dynamics, it would be difficult to predict specific changes in aquatic macroinvertebrate and plankton communities that might potentially result from a future proposed action or operational change. Based on the review of existing information and field study results we anticipate being able to identify a general level of impact or qualitative change to the aquatic communities of concern. For example, a proposed action that would result in significantly increased turbidity would be expected to have a strong impact on phytoplankton and primary production as well as associated cascading trophic effects. This study will collect information to assess whether on-going project operations or changes in project operations may affect the aquatic macroinvertebrate and plankton resources present within or transitory to the Oroville Facilities project area.

2.0 Study Objectives

The overall goal of this study is, first, to describe the aquatic macroinvertebrate and plankton resources located within the project boundary and, second, to evaluate the potential impacts to these resources that are a result of ongoing Project operations. The study will focus specifically on macroinvertebrates and plankton as they are indicators of overall water quality and the prey base for fish. Specific study objectives are listed below.

Objective 1. Describe the aquatic macroinvertebrate, phytoplankton, and zooplankton communities found within project waters including information on community structure and their habitat conditions.

Objective 2. Qualitatively evaluate effects on the aquatic macroinvertebrate and plankton communities that may result from current operations or operational changes at the Oroville Facilities.

3.0 Relationship of Relicensing/Need for Study

Section 4.51(f)(3) of 18 CFR requires reporting of certain types of information in the Federal Energy Regulatory Commission (FERC) application for license of major hydropower projects, including a discussion of fish, wildlife, and botanical resources in the vicinity of the project. The discussion needs to identify the potential effects of the project on these resources, including a description of any anticipated continuing effect for on-going and future operations. This study fulfills these requirements, by evaluating the potential effects on aquatic macroinvertebrate and plankton communities within the project boundary.

As part of the relicensing action, and to be consistent with the National Environmental Policy Act (NEPA 1969), FERC requires an analysis of the potential impacts associated with continuing operation of the power generation facility. In part DWR is required to:

1. define operational issues identified through a collaborative process between DWR and representatives (sometimes referred to as stakeholders) from agencies within the State of California, federal agencies, Indian Tribes, local governments, and other interested members of the public.
2. present study plans designed to evaluate the identified issues and determine the extent and significance of operational impacts associated with continued operation of the facilities.

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3. detail potential protection, mitigation, and enhancement measures that will ameliorate negative impacts identified through the implementation and completion of the proposed study plans. Numerous issues, concerns, and comments surfaced during the collaborative scoping process. Based on stakeholder feedback derived through the collaborative process, it is apparent that continuation of the present operating scenario or some alternative to the current mode of operation at the Oroville Facilities is perceived to have potentially adverse effects upon fish and non-fish aquatic resources inhabiting the Project area. This study is designed to respond specifically to those issues, concerns, and comments regarding the aquatic macroinvertebrate and plankton resources.

4.0 Study Area

The overall study area is defined as the waters within the project area or boundaries. In order to assess the potential project effects, the study area would be divided into nine distinct habitats as follows.

1. Transition zones between inlet tributaries and Lake Oroville (TZ),
2. Lake Oroville Reservoir (LOR),
3. Thermalito Diversion Pool (TDP),
4. Thermalito Forebay (TPF),
5. Thermalito Afterbay (TCA),
6. Power Plant/Fish Barrier Reach (PPR),
7. Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet (LFC),
8. Lower Feather River downstream from the Thermalito Afterbay Outlet to Honcut Creek(LFR),
9. Oroville Wildlife Area Ponds

This study will include waters in the Feather River downstream from the Fish Barrier Dam to Honcut Creek. Below Honcut Creek there is significantly increased tributary influence and substantial change in river streambed composition that would compromise potential comparisons with sites upstream as well as our ability to assess the influence of the project. In addition, this downstream extent of the study area is consistent with macroinvertebrate gravel sampling that is proposed for study plan SP-W1.

These nine habitats were delineated on the basis of the aquatic conditions including velocities, temperatures, substrates, and surface fluctuation differences. In addition, some operational scenarios may affect one type of habitat more than another type.

Study plans approved by the Environmental Work Group define the limits of the study area. If initial study results indicate that the study area should be expanded or contracted, the Environmental Work Group will discuss the basis for change and revise the study area as appropriate.

5.0 General Approach

Objective 1. Describe the aquatic macroinvertebrates and plankton communities found within project waters including information on community structure and their habitat conditions within the project waters.

Task 1–Literature and Data Review

The first task to accomplish this objective is a thorough review of existing literature and project data for information on the composition and abundance of plankton and aquatic macroinvertebrate communities residing within project waters, the life history requirements of aquatic macroinvertebrates and plankton, and project reservoir and stream water quality. The primary sources of data for the project area will be those being developed in Study Plan SP-W1 and a DWR-CSU, Chico invertebrate study. SP-W1 is collecting monthly data about phytoplankton and zooplankton communities from five sites in the arms and main body of Lake Oroville, Diversion Pool, north and south Forebay and Afterbay, Wildlife Area Ponds, and Ponderosa Reservoir. SP-W1 will also be collecting aquatic macroinvertebrates in September 2002 from tributaries (West Branch, Concow Creek, North Fork, Middle Fork, South Fork, Sucker Run, and Glen Creek) and eleven sites in the Feather River downstream from the Fish Barrier Dam to the confluence of Honcut Creek, as well as eight additional sites downstream to the confluence of the Feather River with the Sacramento River as indicators of water quality. The aquatic macroinvertebrate data collected in the fall by SP-W1 should be sufficient to analyze project effects, since nearly all members of the aquatic community are present during this period prior to fall emergence. During other portions of the year, the aquatic macroinvertebrate community may suffer from washout due to high seasonal flows (winter/spring) or be composed of recently hatched immature insects (summer) that may pass through the collection screen and are difficult to identify. The DWR-CSU Chico study is collecting data upstream and downstream from the Afterbay Outlet on benthic and drifting macroinvertebrates.

The purpose of the literature review for this task is to review available and pertinent information on the physical, chemical, and biological parameters that might influence the macroinvertebrate and plankton communities in project waters.. SP-W1 will provide the necessary information about physical and chemical parameters, in addition to information about phytoplankton, zooplankton, and aquatic macroinvertebrate communities, needed for site specific analysis. Additionally, it is important to review all available information that describes the relationship between water quality changes, plankton, and aquatic macroinvertebrate production both within and outside the project area.

The goal of the data and information review is to compile sufficient information to describe current conditions and address the potential effects of future operations on aquatic macroinvertebrate and plankton communities present in both the impounded and free-flowing freshwater habitats within the facility boundaries. Upon completion of this task, a preliminary draft report will be developed and delivered to DWR and the Environmental Workgroup for review. If initial study results indicate that the methods and tasks should be modified, the Environmental Work Group will discuss the basis for change and revise the study plans as appropriate.

Objective 2. Qualitatively evaluate effects on the aquatic invertebrate and plankton communities that may result from current operations or operational changes at the Oroville Facilities.

Task 2. Develop qualitative relationships between project operation and operational changes and existing aquatic macroinvertebrate and plankton communities.

Information and data collected from Task 1 will be analyzed to determine potential on-going project effects on aquatic macroinvertebrate and plankton communities. The level of this evaluation will be limited to a qualitative, directional assessment, i.e. a general assessment of likelihood of a positive or negative effect using

a five-point scale (strongly positive, positive, neutral, negative, strongly negative). Potential changes in physical and chemical conditions from potential future changes in project operations will be obtained from other study plans, such as SP-W1. Based on the literature review for determination of life history requirements for plankton and macroinvertebrates, the general effects of physical and chemical alterations from future project operations on plankton and macroinvertebrate communities will be determined based on scientific judgement. The product for this task will constitute a draft chapter in the study report that includes a table or matrix summarizing the potential effects.

Task 3. Prepare an interim progress and final study reports.

An initial progress report will be prepared that describes the results of Task 1. This report will be delivered to the Environmental Work Group for review in March 2003. Results from Task 2 and the previous interim report will be incorporated into a final study report by June 2004 that will describe the existing condition of the aquatic macroinvertebrate and plankton resources within the project waters and will describe potential connections between project operations and these resources.

6.0 Results and Products

The results and products (deliverables) generated by this project are described in Task 3 above. The final product of this study will be a report that defines the existing condition of the aquatic macroinvertebrate and plankton resources and assesses the potential of operational changes to impact these resources within the project waters.

7.0 Coordination and Implementation Strategy

Coordination with Other Resource Areas/Studies

Throughout this study plan the importance of coordinating with other study efforts has been highlighted. Some study plans have been developed to address one or more of the issues, which will increase the overall coordination requirements associated with this study. Some key study plans would be: SP-F3.2 – Evaluation of Project Effects on Non-salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, SP-F5/7 - Evaluation of Fisheries Management on Project Fisheries, SP-F10 - Evaluation of Project Effects on Salmonids and their Habitat in the Feather River Below the Fish Barrier Dam, SP-G1 – Effects of project Operations on Geomorphic Processes Upstream of Oroville Dam, SP-G2 – Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam, SP-W1 – Project Effects on Water Quality Designated Beneficial Uses, and SP-W2 – Contaminant Accumulation in Sediments and Aquatic Food Chains.

Issues, Concerns, and Comments Tracking/Compliance Requirements

As has been noted, there are several issues that have been raised through the collaborative process discussed in the introduction to this study plan. Most of the issues associated with the study or evaluation of plankton and aquatic macroinvertebrates (variability and production levels) are related to water quality or prey (food) base for warm-water or cold-water fish species.

There are some concerns related to the development of study plans intended to assess the issues raised within the context of current and future operations. Typically the issue of “operational impacts” or “project

implementation impacts” is addressed prior to implementation of the project. In this case, the project was designed, constructed, and in operation by 1968 and very little is known about macroinvertebrate production within the project area prior to project implementation. As a result this study is constrained to evaluate only the existing conditions under the assumption that the current operations will continue throughout the study period. An additional constraint is the inability to test actual conditions for any proposed operational changes that might be implemented in response to the various studies being conducted as part of the overall relicensing process.

Other study plans will more definitively address those regulatory and compliance issues associated with the water quality impacts (perceived or real) related to the operation of the project. Macroinvertebrate assessments generally provide indications of water quality conditions but there are no regulatory compliance items directly associated with their composition or production. There may, however, be FERC License Conditions that are associated with the operation of the facilities and the production of aquatic macroinvertebrates or plankton. This study fully or partially addresses the following issues:

Stakeholder Issues Fully Addressed by the Study Plan Evaluation of Project Effects on Non-Fish Aquatic Resources	
Issue	Description
FE8	Lake Oroville releases made for power generation may cause dramatic fluctuations in lake level. What are the potential impacts of fluctuation zone and surface elevation change on recreation opportunities and on fish and wildlife habitat? Also addressed in SP-F3.1;
FE83	Macroinvertebrates as an indicator of water quality; also addressed in SP-W1;
FE86	Adequacy of current ramping rate to protect anadromous salmonids and conserve their habitats and forage. This includes providing a range of schedule of flows necessary to optimize habitat, stable flows during spawning and incubation of in gravel forms, flows necessary to ensure redd replacement in viable areas, and flows necessary for channel forming processes, riparian habitat protection and maintenance of forage communities. This also includes impacts of flood control or other project structures or operations that act to displace individuals or their forage or destabilizes, scours, or degrades habitat; also addressed in SP-F10, SP-G2, and SP-F16;
FE89	Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitats; also addressed in SP-F10 and SP-W1;
FE90	Adequacy of current project operating regimes and structures to optimize water quality conditions for anadromous salmonids and their habitats; also addressed in SP-F10, SP-W1;
FE91	Current condition of habitat potentially impacted by project and alternatives to conserve or enhance anadromous salmonids; also addressed in SP-F10, SP-W1;

Stakeholder Issues Fully Addressed by the Study Plan Evaluation of Project Effects on Non-Fish Aquatic Resources

Issue	Description
FE95	The lower Feather River provides habitat to support a variety of anadromous fish species including Chinook salmon, steelhead, striped bass, American shad and sturgeon. Potential changes in license conditions could adversely impact habitat supporting these species. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of anadromous species including flow, water temperature, instream and riparian cover, substrate and spatial area; also addressed in SP-F10, SP-F3.2, SP-F16, SP-W6, SP-G2, and SP-T4;
FE96	The lower Feather River provides habitat to support a variety of resident native and resident introduced species including coldwater species such as rainbow, brook, and brown trout, and warm water species such as bass, catfish, bluegill, green sunfish, carp and others. Potential changes in license conditions could adversely impact habitat supporting these species or upset habitat conditions such that less desirable species are favored. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of these resident native and non-native species including flow, water temperature, instream and riparian cover, substrate and spatial area; also addressed in SP-F10, SP-F3.2, SP-F16, SP-W6, SP-G2, and SP-T4;
FE97	The habitat for fishes in the lower Feather River is affected by the flow releases from the project. Seasonal timing, volume, and rate of release all have an affect on fish habitat conditions. Potential changes in license conditions for flow releases could adversely affect habitat conditions for one or more fish species. Fishery investigations should examine the adequacy of flows for maintaining all life history needs for anadromous and resident species. There should be evaluation of potential for flow improvements in the low-flow section. Fishery investigations should be sufficient to determine how best to meet the combined needs of the various anadromous and resident fish species; also addressed in SP-F16, SP-F10, and SP-3.2;
GE23	Releases that reflect nature cycles benefit biological cycles – how have changes in seasonal release patterns affected fish, invertebrates, and their habitat; also addressed in SP-F10, SP-3.2, and SP-16;

Stakeholder Issues Fully Addressed by the Study Plan Evaluation of Project Effects on Non-Fish Aquatic Resources

Issue	Description
GE25	Natural geomorphological processes historically occurred within the Feather River watershed and are the result of geologic and hydrologic processes such as weathering, erosion, runoff patterns, material transport and deposition. Project features and operations have altered these natural geomorphic processes. Alteration of these geomorphic processes has affected the riverine habitat and species that depend on it. The FWS is concerned that project operations may have taken us beyond some critical thresholds for ecosystem sustainability. We are concerned that maintenance of a satisfactory abiotic template (e.g., substrate used for invertebrate production and fish spawning) is not occurring). The FWS wants assurance that new license conditions will allow for minimum thresholds of geomorphic processes to take place thus ensuring sufficient natural sediment movement and a satisfactory abiotic habitat template are in place; also addressed in SP-G2, and SP-F10;
G1	Effects of existing and future project operations on natural geomorphic processes. These include physical attributes and functions (e.g., channel morphology, channel stability, sediment transport and deposition, spawning gravel and large woody debris recruitment, habitat diversity) and subsequent effects on biological resources (e.g., aquatic macro-invertebrates, riparian vegetation) in the low-flow section and in the Feather River downstream of Thermalito Afterbay under wet and dry year criteria. Also, see W8, F3, F10, T5; also addressed in SP-F10, SP-F3.2, SP-G2, and SP-T4;
W1	Effects of existing and future project operations and facilities on all designated beneficial uses of the water. The beneficial uses for the Feather River watershed as defined in the Basin Plan include municipal and domestic supply, agriculture, electrical power production, contact recreation, warm-water and cold-water fish spawning, rearing and migration, freshwater habitat, and wildlife habitat; also addressed in SP-F10, SP-F3.2, and SP-E1;
W3	Effects of existing and future project operations on the physical, chemical and biological components of water quality of the Feather River, affected tributaries and downstream waters. The project has the potential for direct and indirect effects on aquatic ecosystem health, on recreational opportunity, and on domestic and agricultural water supply; also addressed in SP-W1;
W10	Effects of existing and future water releases and operations on water temperatures in the Diversion Pool, Forebay, Afterbay, Oroville Wildlife Area, low-flow section of the river and downstream areas; at the hatchery; for agriculture; and the quality and availability of habitat for salmonids and other aquatic resources; also addressed in SP-F10, SP-F3.2, SP-F9, and SP-F3.1;

8.0 Study Schedule

The literature review associated with Task 1 will begin during the summer of 2002. Monthly plankton sample collection associated with Study Plan SP-W1 began in March 2002, while aquatic macroinvertebrate sample collection is scheduled for September 2002. A progress report describing the results of the literature review and sample collection to date will be prepared for Environmental Work Group review in March 2003. A final study report incorporating the progress report, additional results from field sampling, and results from Task 2 will be completed by June 2004.

9.0 References

NEPA 1969. The National Environmental Policy Act of 1969, as amended (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, § 4(b), Sept. 13, 1982)